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PAWS 2023

2ND PEST ANIMAL & WEED SYMPOSIUM

28 - 31 AUGUST 2023, DALBY EVENT CENTRE

CONFERENCE PROCEEDINGS

PRESENTED BY isq

HOSTED BY WESTERN DOWNS REGIONAL COUNCIL

HISTORY, STATUS AND FUTURE CHALLENGES FOR MIMOSA PIGRA ERADICATION IN QUEENSLAND

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ABSTRACT

Mimosa pigra (M. pigra), one of the world's worst weeds, was discovered on the margins of Peter Faust Dam in Central Queensland in February 2001. While infestations are extensive in the Northern Territory, this is the only known incursion of this weed in Queensland. For the past 22 years, the infestation has been the focus of a multi-stakeholder led eradication program costing over $4 million.

Integrated control activities successfully controlled the original infestation within a few years of detection. Ongoing efforts have enabled the detection and destruction of seedlings, thereby progressively depleting the long-lived residual seedbank. These efforts have required adaptive management that considers the weed's biology while also addressing surveillance gaps, refining survey focus, improving governance and enhancing stakeholder involvement.

Though eradication remains on track, future challenges remain including field operational difficulties, an indeterminate eradication timeframe, evolving stakeholder responsibilities, risk-based program refinement and the continuing threat of new incursions to Queensland.

Keywords: *Mimosa pigra*, weed eradication, weed surveillance.

INTRODUCTION

Mimosa pigra, native to Tropical America and one of the world's worst weeds, was discovered on the margins of Peter Faust Dam in Central Queensland in February 2001. This was the first and only known incursion in Queensland. Since its discovery, the infestation has been the focus of an eradication program led by Biosecurity Queensland (BQ), in conjunction with Whitsunday Regional Council (WRC), Sunwater, Proserpine Station and other stakeholders.

The weed's biology and invasive capacity have added to the difficulties in progressing eradication. Each *M. pigra* plant can produce 220 000 seeds annually (Lonsdale 1992), the extremely hard coat of which enables them to remain dormant for up to 23 years (Lonsdale 1992). Additionally, plants are capable of flowering and podding as early as 67 days and 155 days respectively after seedling emergence and can flower and seed year-round at Peter Faust Dam (Vitelli *et al* 2006).

BQ has progressed eradication efforts at the dam, successfully controlling the initial infestation and maintaining surveillance to prevent reestablishment and progressively deplete the soil seed load. Over $4 million has been invested in the eradication project since

2001. Here we discuss infestation history, surveillance and adaptive management approaches, and future challenges.

INFESTATION HISTORY

An unknown prickly shrub, subsequently identified as *M. pigra*, was discovered by the landholder at Peter Faust Dam near Proserpine in Central Queensland in February 2001. Through delimitation activities, the original core infestation was mapped at 300 ha, mostly in the south-west corner of the dam with scattered outliers in north-west and south-east sections. When found, the dam level was approximately 75% but the core infestation with mature plants had already been partially inundated between the 32 – 45% dam water level.

The invasion pathway wasn't definitively confirmed, though recreational fishing has been ascribed as the most likely vector (Vitelli *et al* 2011). Peter Faust Dam is a magnet for barramundi fishing enthusiasts who may have inadvertently brought *M. pigra* seeds in their boats or tackle after fishing activities in the heavily infested Northern Territory 'Top End'.

All mature infestations were effectively controlled during 2001 – 2004 using integrated mechanical, herbicide and manual treatment methods (Chopping 2004). As water levels increased and *M. pigra* grew through the water column, officers manually removed plants via boat. Additionally, fire was used to destroy soil surface seedlings and seed.

From 2007, the water level at the dam increased year-on-year with inflows greater than outflows and evaporation. In 2008, water submerged the core infestation area and most of the soil seed bed. Water level at the dam has exceeded 45% since this time.

Following successful management of the original infestation, the operational objective has been to detect plants prior to maturity and progressively deplete the soil seed load. While this has been highly successful, there have been two significant plant detection misses – a mature seeding plant was found on 15 August 2016 and another on 12 August 2020. Both were found in what is now referred to as Pigra Creek in the north-west area of the dam. Operational improvements were identified in 2020 to further increase the likelihood of plants being detected prior to maturity.

SURVEILLANCE APPROACHES AND RESULTS

The dam is divided into five operational sections with each section systematically surveyed. Surveillance is primarily conducted by utility terrain vehicle (UTV) with tracks of routes recorded and location data uploaded for any detections. While all of the dam margins are surveyed, extra attention is given to the vicinity of the original core infestation and where mature plants have been detected. Surveillance of high-risk areas occurs up to six times annually to reduce the risk of undetected plants and seeding events. This usually provides two field survey opportunities to detect seedlings before maturity.

Surveillance was achieved by a team of two officers from 2005 until 2010 after which the Program primarily relied on a single field officer with sporadic WRC support. Increased BQ support was provided from 2020 and joint taskforce arrangements with WRC were reinstated.

Plant detections dropped significantly after 2005 (Figure 1). From 2011 to 2015, only nine plants were found due principally to the dam's high water levels (69 to 93%) and a largely submerged soil seed bed. The highest water level at which a detection has been recorded is 87% in 2013.

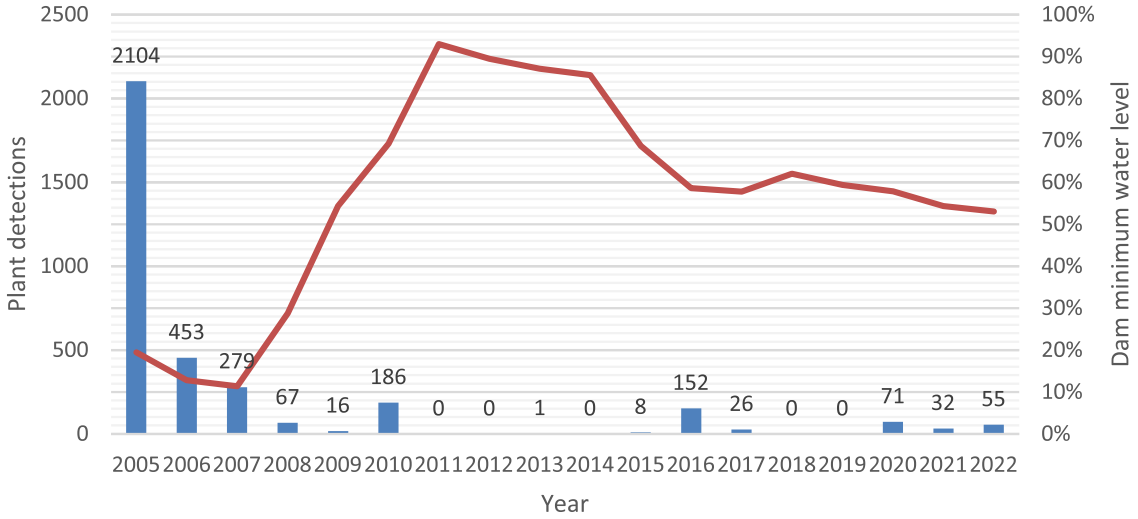

Figure 1. *M. pigra* plant detections relative to dam water level since 2005.

Two detection spikes have occurred since 2010, the first in 2016 (152 plants) as the edges of the soil seed bed were exposed for the first time in six years. The second spike over 2020 – 2022 (158 plants) was due largely to the 2020 mature plant seeding event in Pigra Creek and moderately reduced water levels.

ADAPTIVE MANAGEMENT TO ADDRESS OPERATIONAL CHALLENGES

Eliminating surveillance gaps

Detections of mature seed-producing plants can seriously threaten the eradication objective and re-set the timeframe required to exhaust the soil seedbed. Consequently, the mature plant detection of 2020 necessitated critical refinements to the surveillance program. This plant was found in Pigra Creek, approximately 500 m upstream of the dam foreshore perimeter. The event was evidently caused by rising dam water levels transporting a seed to an upstream section of the creek not frequently surveyed. To reduce the risk of this occurring in future, intensive on-foot surveys are now undertaken annually of all gullies and creeks flowing into the western side of the dam consistent with predominate wind direction from the south-east. These intensive surveys now occur as joint BQ-WRC taskforce activities.

Analysing data to refine surveillance effectiveness and efficiency

Data sets have been recorded and collated for detection location, date and water since 2005 and all surveillance tracks recorded since 2016. The greatest benefit in the data has been refinement of geographic areas for surveillance focus. For example, in the 22 years since program implementation, *M. pigra* has never been detected on the north eastern and north sides of the dam. This area accounts for up to 25% of the dam perimeter and associated surveillance effort. Based on this finding, BQ has reduced surveillance frequency in these areas from six times to once annually.

Water levels at the dam have also been analysed to guide surveillance as much of the original seed bed remains submerged (mostly within the dam's 32 – 45% water levels) and requires exposure to facilitate germination. Any decrease of water level below 45% will prompt a need for increased surveillance and consideration of taskforce approaches. Low water levels will also increase the area to be surveyed with larger areas of the dam foreshore exposed. Since 2008, however, the dam has remained at over 45% capacity, therefore most of the seed bed remains submerged.

It was hoped that seasonality of detections could assist in determining surveillance intensity over a calendar year but analysis of data from 2004 – 2006 included detections during every month. More recently, detections have been recorded in 10 of 12 months in 2022.

Governance safeguards and improvements

M. pigra surveillance at Peter Faust Dam, by its nature, requires intricate field and operational knowledge and skills. To reduce reliance on one field officer and potential staffing impacts associated with Covid-19, additional Biosecurity officers have become familiarised with the dam and surveillance processes. Contingency planning has also occurred to address risks associated with Program interruptions. The development of a new eradication plan has further improved overall governance.

Re-invigorating stakeholder involvement

Like most eradication programs, *M. pigra* eradication was initially characterised by high levels of interest and activity by many stakeholders. However, as the Program timeframe extended and detections declined, activities became routine and stakeholder meetings discontinued. To re-invigorate a multi-stakeholder approach, a *Mimosa pigra* Stakeholder Group meeting was held in April 2022 where the status of the Program was reviewed, and organisational responsibilities discussed. Subsequently, and at the request of stakeholder members, a new eradication operational plan was produced (March 2022) as a blueprint for progressing outcomes and collaborative involvement. An immediate tangible outcome of the plan and related discussions, was Sunwater's upgrade of the dam's perimeter track, allowing easier access for surveillance.

Preventative surveillance at other at-risk sites

Recreational fishing has been attributed as the likely invasion pathway at Peter Faust Dam and, with other recreation-based human movement, are the highest ongoing interstate movement risks. However, migratory water birds are also arguably a possible risk as observations by the principal author and a senior officer from Western Australian Department of Agriculture and Food (Wilson 2023) implicate the three known incursions in the Kimberley Region to water bird vectors. Long-distance movement of weeds by birds is also supported by other studies (Reynolds *et al* 2015). At-risk sites in Queensland should be prioritised with consideration of these dispersal factors and opportunistically surveyed. In Central Queensland, a preventative surveillance plan has been implemented with three impoundments, a natural lake and two floodplains surveyed since 2020 with no detections.

FUTURE CHALLENGES

The management of *M. pigra* at Peter Faust Dam has been successful, contributing to and maintaining eradication objectives for this site. While surveillance has prevented the re-

establishment of infestations, and seed loads are thought to be declining, notable challenges remain for achieving eradication at Peter Faust Dam and early detection elsewhere in Queensland.

Field operations

The operational field difficulties associated with finding *M. pigra* plants at Peter Faust Dam before they mature should not be underestimated. These difficulties include the size of the area to be searched, terrain and accessibility issues, vegetation obstacles, changing dam water levels, variable weather conditions and the need to maintain consistent survey cycles by skilled and dedicated personnel.

Managing for an indeterminate eradication timeframe

While the original infestation was successfully controlled during 2001 – 2005, most of this area remains submerged below the dam's 45% water level. However, since 2008, the dam has remained over this level. Only if water levels recede due to drought, lack of in-flows, or irrigation use are seeds exposed and dormancy broken by fluctuating temperatures (Dillon and Forcella 1985). Research has thus far been unable to assess viability of the remaining seeds. While Lonsdale (1992) indicates seed longevity of up to 23 years, there is uncertainty of any finite limit within the field conditions present. Intended research into seed viability could not progress when soil sampling conducted when the dam was about 50% failed to retrieve seeds (Vitelli 2022).

Evolving stakeholder responsibilities and risk-based program refinement

Field learnings and data analysis will continue to guide *M. pigra* surveillance at Peter Faust Dam. As detections continue to decline, the requirement for continuance of the Program in its existing form and resourcing will be scrutinised. Existing BQ-led arrangements may evolve with an increase in responsibilities for other stakeholders. This will require an evaluation of options and identification of risks for maintaining Program outcomes.

Invasion pathways and incursion threats remain

There have been no further known incursions of *M. pigra* in Queensland since the Peter Faust Dam infestation was found in 2001. The probability of another incursion appears low but remains possible through human and waterbird movement pathways. Surveys of at-risk sites are advocated in addition to the facilitation of passive surveillance through targeted stakeholder and community awareness. Signage at Peter Faust Dam, awareness products and presentations to stakeholder groups facilitate awareness.

ACKNOWLEDGMENTS

Many state government, local government and other officers have contributed directly to the eradication program at Peter Faust Dam and are thanked for the legacy provided by their efforts. In addition, members of the *Mimosa pigra* Stakeholder Group, including representatives of WRC, Sunwater, Proserpine Station, Reef Catchments NRM and Proserpine Canegrowers are acknowledged for their individual and collective contributions.

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